

CLAIMS

What is claimed is:

1. A method for automated tracking and identification nonuniform elements of a set, said method comprising the steps:

- 5 a. Initial weighing of and recording said weight of said completed set of nonuniform elements;
- b. Weighing of and recording said weight of each individual element of said set;
- c. Recording of an image of each individual element of said set; and
- 10 d. After disassembly and reassembly of said set, verifying set completeness by comparison of the final weight and element quantity of said set.
2. The method of Claim 1, wherein the weighing of each individual element of said set is prompted by an automatic tracking system and recorded
- 15 within an electronic database for future recall.
3. The method of Claim 2, wherein the recording of an image of each individual element of said set is prompted by an automatic tracking system and recorded within an electronic database for future recall.
4. The method of Claim 3, wherein if set completeness cannot be verified,
- 20 said automatic tracking system performs a counting and identification method comprising:

- a. Comparing the differences between said initial weighing and said final weighing to determine a differential weight;
- b. Comparing said differential weight against the weight of each individual element; and
- 5 c. Identifying a list of possible individual elements that could comprise said differential weight.

5. An automatic tracking system for performing the method of Claim 1, comprising:

a scale for initial weighing of said completed set of nonuniform elements
10 and each said individual element of said set;

an image processing application for capturing, storing, and processing said image of each set element for storage in a computer data file; and

electronic database recording and retrieval means for recording, retrieving, comparing and manipulating weight and image data identified or
15 captured by said scale and said image processing application.

6. A method for automated tracking and identification of surgical instruments in a surgical room environment comprising:

- a. Measuring the weight of individual surgical instruments belonging
20 to a complete standardized surgical instrument set prior to sterilization by placed on a scale each said surgical instrument one

at a time according to a prompt;

- b. Storing the weights of the individual surgical instrument in a computer data file;
- c. Assigning a serial number to the complete standardized surgical instrument set for allowing retrieval of information regarding instrument weights during an operation.
- d. Automatically verifying set completeness during set assembly by the automatic counting and comparing of weights of measured pieces with nominal weights of this particular type of individual surgical instrument stored in a database;
- e. If a mismatch occurs, then interactively pointing to potentially missing parts identified from said database.

7. The method of Claim 6, wherein said mismatch is identified by:

- a. Placing a restriction that the weight of instruments of the same type cannot differ by more than two times (ratio between minimum and maximum weights of the same type instruments) to prevent rounding off error in any subsequent identification routine;
- b. Identifying an instrument quantity to instruct the user on the specific quantity of the individual surgical instrument needed in each complete standardized surgical instrument set;
- c. Spreading individual surgical instruments on a platform divided into

segments, with the individual surgical instrument of the same type being placed within the same segments and the platform weighed by a scale;

- d. Viewing said segmented platform by a video camera connected to a computer equipped with an image processing application;
- e. Placing upon a user an identifying indicia with a specific shape imprint on it with a color or imprint specifically chosen to differentiate it from the background;
- f. During removal of a surgical instrument, identifying a weight change above a specified level while signaling the computer equipped with said image processing application the position of the identifying indicia relative to the segmented platform during said weight change;
- g. Acquiring, by said computer equipped with an image processing application, a weight differential prior and after placement or withdrawal of the individual surgical instrument such as to be able to identify which instrument was removed from said platform;

wherein by adding up the weight of unused and used instruments and comparing it with the initial weight, verification of set completeness can be done in a single step.

- 8. The method of Claim 7, wherein said identification subroutine comprises

the steps:

- a. Determining average weight of the individual surgical instrument placed within the same segments based on the stored information defined by the formula:

$$X_j = \frac{\sum_{i=1}^n x_i}{n}$$

where, X_j is the average weight of the individual surgical instrument placed in a segments identified by number j and n is number of the instruments in segment j ;

- b. Comparing the average weight to said weight differential; and
- c. Based on the estimated number of pieces removed from each segments, determining a combinatory sum of weights for the estimated number of individual surgical instrument determined in each segments of interest;

wherein said combinatory sum is all possible combinations of weights of the estimated number of individual surgical instrument positioned within the segments of interest.

9. The method of Claim 8, wherein determining said combinatory sum comprises the steps:

- a. Estimating the number of pieces placed or removed from said table by dividing the weight differential by the average weight in any particular segment;
- b. Summing the estimated number of pieces for each segment;
- 5 c. Rounding the sum of the estimated number of pieces to the nearest integer; and
- d. Confirming the estimated integer by verifying equality of weight differential with the sum of the product of the average weight differential of the estimated number of pieces in the specific
10 segment and surrounding segments.

10. A method for counting of surgical consumables comprising the steps:

- a. detecting new or sterile consumables withdrawals the method of Claim 6; and
- 15 b. returning soiled consumables to a disposal bag monitored by use of a thru beam detection system which counts individual soiled consumables returned.